

Confidential Information



Multisession Compact Disc

Specification

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SONY

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I. General

I.1 Scope

This document gives the general specification for Multisession discs. Both Read Only discs and finalized CD-WO Multisession discs are covered by this specification. Definitions that are related to recording on a CD-WO disc, are given in the Orange Book only.

The differences between the Multisession CD specification and the CD-WO specification version 2.0 are:

- The Skip features (see Orange Book chapter 5.4.3) are available for Single Session CD-WO Audio discs only.
- The CD-WO specification version 2.0 describes that all Sessions on a Multisession disc must be Data Sessions. The Multisession CD specification allows both Audio Sessions and Data Sessions on one disc.
- The CD-WO specification version 2.0 describes that a Data Session must contain minimum one Data Track. The Multisession CD specification requires that the first Track of a Data Session is a Data Track.
- The CD-WO specification version 2.0 specifies the Disc Format (chapter 5.5.2, Mode 1 POINT=\$A0). The Multisession CD specification specifies the Session Format, depending on the format of the Session (CD Audio, CD-ROM XA, CD-I).

I.2 Conformance

The Multisession CD Specification conforms to the mandatory requirements specified in this document. All parts in this document are mandatory unless they are specially defined as recommended or optional or informative.

Multisession CD also conforms to the applicable parts of the system descriptions or international standards that are listed below:

- CD Audio: Compact Disc Digital Audio, specified in the System Description Compact Disc Digital Audio ("Red Book"), N.V. Philips and Sony Corporation.
- CD-ROM: Compact Disc Read Only Memory, specified in the System Description Compact Disc Read Only Memory ("Yellow Book"), N.V. Philips and Sony Corporation.
- CD-WO: Compact Disc Write Once, specified in the System Description Recordable Compact Disc Systems Part II, Version 2.0 ("Orange Book"), N.V. Philips and Sony Corporation.
- CD-ROM XA: Compact Disc Read Only Memory eXtended Architecture, specified in the System Description CD-ROM XA, N.V. Philips and Sony Corporation.
- CD-I: CD-I Full Functional Specification, N.V. Philips and Sony Corporation.
- ISO 9660: Information processing - volume and file structure of CD-ROM for information interchange. Ref. No. ISO 9660 : 1988 (E).
- ISO 646: Information processing - ISO 7-bit coded character set for information interchange. Ref. No. ISO 646 : 1983 (E).
- ISO 8859-1: Information processing - ISO 8-bit single byte coded graphic character sets. Part I: Latin alphabet No. 1. Ref. No. ISO 8859-1 : 1987 (E).
- ISO 2022: Information processing - ISO 7-bit and 8-bit coded character sets - coded extension techniques. Ref. No. ISO 2022 : 1986 (E).

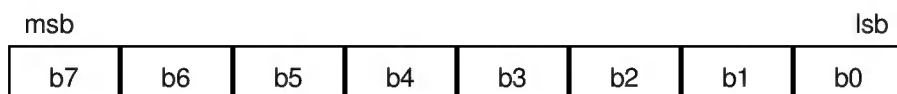
I.3 Conventions

Unless otherwise indicated, in this document the conventions used are as follows:

Bit ordering

The graphical representation of all multiple-bit quantities is such that the most significant bit (msb) is on the left and the least significant bit is on the right.

Figure I.1 Example of bit ordering for one 8 bits byte



The most significant bit is the bit with the highest bit position number.

Bit designation

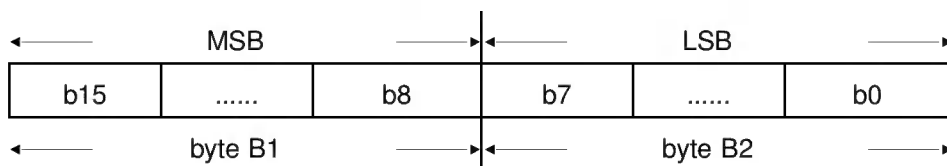
Bit#i denotes the bit with bit position i, according to Figure I.1.

Byte ordering

Quantities which require more than 8 bits for their representation are held in more than one byte on the disc. For all such quantities, the ordering of bytes on the disc is such that the Most Significant Byte (MSB) is first and the Least Significant Byte (LSB) is last.

Multiple-byte quantities are represented graphically such that the left-hand-most or upper-most byte is most significant and the right-hand-most or lower-most byte is least significant.

Figure I.2 Example of byte ordering for 2 bytes



The most significant byte is the byte with the lowest byte position number.

Byte designation

Byte#i denotes the byte with byte position i, according to Figure I.2.

Strings

Strings are always given between double quotation marks, p.e. "_____".

Hex

All Hexadecimal values are preceded by a \$. The most significant nibble is on the left, the least significant nibble is on the right.

Binary

All Binary values are preceded by a %. The most significant bit is on the left, the least significant bit is on the right. A Binary value is represented by a 0, 1 or x where x is a 0 or a 1.

Decimal

All Decimal values are preceded by a blank space or the range indicator (..) when included in a range. The most significant digit is on the left, the least significant digit is on the right.

Units of measure

1K denotes 1024 units. 1k denotes 1000 units.

Range

Constant_1..Constant_2 or (Constant_1..Constant_2) denotes the range from and including Constant_1 up to and including Constant_2, in increments of 1.

Ordering within tables

The items within a table are contiguous, starting with the top line from the left to the right item, then the next line from the left to the right item, and so on, down to and including the bottom line from the left to the right item.

Multiplication

Multiplication of two values is denoted by a *.

Sector

Wherever the word "Sector" is used in this document it has the identical meaning as the word "Block" in the CD-ROM system description.

Sector, Subcode address

All Sector addresses and Subcode time codes are represented in the form mm:ss:ff. The Minutes field is represented by "mm", the Seconds field is represented by "ss", the Blocks (Sector) or Frames (Subcode) field is represented by "ff".

I.4 Definitions

Session	An area on a disc consisting of a Lead-In Area followed by a Program Area and a Lead-Out Area is called a Session.
Single Session disc	If a disc contains one Session, this disc is called a Single Session disc.
Multisession disc	If a disc contains more than one Session, this disc is called a Multisession disc.
Track	A Track is a contiguous area on the disc with one and the same Track Number.
Audio Track	An Audio Track is a Track that contains CD Audio information according to the Red Book.
Data Track	A Data Track is a Track that contains Sectorized data according to the Yellow Book.
Mode 1 Track	A Mode 1 Track is a Data Track that contains Sectors in the Mode 1 format.
CD-ROM XA Track	A CD-ROM XA Track is a Data Track that contains Sectors in the Mode 2 Form 1/2 format according to the CD-ROM XA specification.
CD-I Track	A CD-I Track is a Data Track that contains Sectors in the Mode 2 Form 1/2 format according to the CD-I specification.
Data Session	A Data Session is a Session of which the first Track in the Program Area is a Data Track.
Mode 1 Session	A Mode 1 Session is a Session of which the first Track in the Program Area is a Mode 1 Track.
CD-ROM XA Session	A CD-ROM XA Session is a Session of which the first Track in the Program Area is a CD-ROM XA Track.
CD-I Session	A CD-I Session is a Session of which the first Track in the Program Area is a CD-I Track according to the Green Book.
Audio Session	An Audio Session is a Session of which all Tracks in the Program Area are Audio Tracks.
MSF format	The Sector Address and Subcode-Q Channel time codes are encoded in the MSF format. The MSF format is a 6 digit BCD encoded number, the first (most significant) two digits contain the Minutes fraction, the next two digits contain the Seconds fraction and the last (least significant) two digits contain the Frames fraction of the Subcode time code or the Sector Address.

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II. Disc specification

The mechanical and physical properties of a Read Only disc are specified in the Yellow Book. The mechanical and physical properties of a CD-WO disc are specified in the Orange Book Part II.

Read Only discs must be recorded in one recording action, it is not allowed that a Read Only disc contains one or more Link Positions (see Orange Book chapter 5.2).

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III. Data Format

The encoding rules for Audio Tracks are as given in the Red Book, unless specified otherwise in this document.

The encoding rules for Data Tracks are as given in the Yellow Book, unless specified otherwise in this document.

The encoding rules for CD-ROM XA Tracks are as given in the CD-ROM XA specification, unless specified otherwise in this document.

The encoding rules for CD-I Tracks are as given in the CD-I specification, unless specified otherwise in this document.

III.1 Sector layout

A CD-WO disc contains Run-in, Link and Run-out Sectors to indicate the physical link position. On Read Only discs, Run-in, Link and Run-out Sectors are not allowed. On Read Only discs, Data Tracks with CONTROL = %01x1 (see chapter III.3.1) are not allowed. If a CD-WO disc is not recorded by means of Uninterrupted Writing, then the Pre Gap of a Data Track must contain the Track Descriptor Block (see Orange Book chapter 5.6.5.1). On Read Only discs, Track Descriptor Blocks are not used.

III.2 Lead-In Area

The length of the Lead-In Area of the first Session on a disc is as specified in the Yellow Book. The length of the Lead-In Area of the second and higher Session(s) on a disc is 01:00:00.

The Lead-In Area contains information about the disc and about the Tracks on the disc. In the Lead-In Area, information is encoded in the Subcode-Q Channel.

In the Lead-In Area of a Session, Subcode-Q Mode 1 is always present. The format of Mode 1 is according to the Yellow Book. Mode 1 contains the Start Addresses of all Tracks and of the Lead-Out Area of that Session.

On a Multisession disc, Mode 5 is present in the Lead-In Area of all Sessions; however, in the Lead-In Area of the last Session, Mode 5 can be omitted (see chapter III.2.1.3).

If both Mode 1 and Mode 5 are present, they must be placed in alternating order, each Subcode Block being repeated three times. When used, Mode 1 and Mode 5 each occupy at least 3 out of 10 successive Subcode Blocks.

An example of the TOC is given in Figure III.3.

III.2.1 Table Of Contents, Subcode-Q Channel

The Table Of Contents (TOC) of a Session is recorded in the Lead-In Area of that Session. The TOC of a Session contains the Start Addresses for the Tracks in that Session. In the TOC the Items are repeated three times each in successive Subcode Blocks. The complete TOC is continuously repeated during the Lead-In Area of a Session.

If the disc is a Multisession disc, then the TOC contains a pointer to the next (possible) Session, see chapter III.2.1.3.

Figure III.1 Encoding in the TOC of a Subcode-Q frame

S0,S1	CONTROL	ADR	00	POINT	MIN	SEC	FRAME	ZERO	PMIN	PSEC	PFRAME	CRC
TNO												

S0, S1 : According to the Yellow Book, page 40.

CONTROL : See CONTROL in Chapter III.3.1, except for bit 1 (the Copy Bit). If ADR=1 (TOC Item) then the Copy Bit is '1' (no copyright) only if the Copy Bit is '1' in all parts of the Track specified by POINT.
Note: The correct copyright status of a Track must always be checked in the program area.

TNO : 00

CRC : 16 bit CRC on CONTROL.. PFRAME (msb first). On the disc the parity bits are inverted. The remainder have to be checked at zero. The check polynomial P(X) is:

$$P(X) = X^{16} + X^{12} + X^5 + 1$$

III.2.1.1 Mode 1

ADR = 1 : Mode 1

MIN, SEC, FRAME : Absolute Time in MSF format.

ZERO : 00

POINT = 01 .. 99

PMIN, PSEC and PFRAME contain in MSF format the Start Address of the Track pointed to by POINT. The Start Address of a Track is the address of the first Sector (and the Absolute Time of the first Subcode Block) following the Pre-Gap of a Track.

POINT = \$A0

- a) PMIN contains the BCD encoded value of the first Track Number in the Program Area of the Session.
- b) PFRAME is 00.
- c) PSEC specifies the Session Format. The definition of the Session Format is given in Figure III.2.

Figure III.2 Session Format

PSEC	Meaning
\$00	CD Audio Session OR CD-ROM Mode 1 Session.
\$10	CD-I Session.
\$20	CD-ROM XA Session.
Other values	Reserved.

POINT = \$A1

- a) PMIN contains the BCD encoded Track Number of the last Track in the Program Area of the Session.
- b) PSEC and PFRAME are 00.

POINT = \$A2

PMIN, PSEC and PFRAME contain in MSF format the Start Address of the Lead-Out Area of the Session.

All not defined values of POINT are reserved for future use.

III.2.1.2 Mode 2

The optional Subcode-Q Mode 2 contains the UPC/EAN code as specified on page 46 of the Red Book and the Yellow Book. A disc only can contain one UPC/EAN code. If a Multisession disc contains the UPC/EAN code, the Lead-In Area and the Program Area of all Sessions of that disc must contain the UPC/EAN code, the UPC/EAN code is allowed in the Lead-Out Areas.

III.2.1.3**Mode 5**

ADR = 5

: Mode 5

POINT

= \$B0

This value of POINT is used for the identification of the Multisession disc.

If the disc is not a Multisession disc, POINT=\$B0 is not present.

- a) MIN, SEC and FRAME contain in MSF format the start address of the Next Program Area on a Multisession disc. On a CD-WO disc, it is allowed that the Next Program Area is not (yet) recorded. The start address of a Program Area is the address of the first Sector (and the Absolute Time of the first Subcode Block) in the Program Area of a Session.
- b) On a CD-WO disc PMIN, PSEC and PFRAME give the maximum start address of the outermost Lead-Out Area on the disc. On a Read Only disc PMIN, PSEC and PFRAME must be equal to the start address of the Lead-Out Area of the last (Final) Session of the disc.
- c) On a CD-WO disc ZERO gives the number of different pointers present in Mode 5. On a Read Only disc ZERO is set to 2 in the first Session and set to 1 in Session 2 and up.

The last Session on a Read Only disc is always designated as the Final Session of that disc. On a CD-R disc, the Final Session is indicated by one of the following two ways:

MIN, SEC and FRAME of POINT=\$B0 each are set to \$FF

or POINT=\$B0 is not present.

On a Read Only disc, POINT=\$B0 is not present in the Final Session of the disc.

POINT

= \$C0

This value of POINT is present in the first Session of a Multisession disc only.

- a) MIN, SEC, FRAME and ZERO are set to zero on Read Only discs. On CD-WO discs, MIN, SEC, FRAME and ZERO are used according to the Orange Book.
- b) On a Read Only disc PMIN, PSEC and PFRAME are set to 95:00:00. On a CD-WO disc PMIN, PSEC and PFRAME are used according to the Orange Book.

POINT

= \$B1..\$B4; 01..40

These values are used on CD-WO discs only, see Orange Book.

All undefined values of POINT are reserved for future use.

III.2.2 Time code and address encoding

With the exception of the end of the Lead-In Area of the first Session, both the Absolute Time and the Sector Address increase monotonically throughout the disc.

The last Absolute Time¹ in the Lead-In Area of the first Session of a Multisession disc is equal to 99:59:74. In the Lead-In Area of the first Session of a Multisession disc, the last Sector Address is equal to 99:59:74 or equal to \$F9:59:74; in the last case, the Minutes fraction of the Sector Address has an offset of \$60 with respect to the Minutes fraction of the Absolute Time.

III.2.3 Subcode-P, -R..W Channels

In the Lead-In Area of a Session, the Subcode-P Channel is set to zero. In the Lead-In Area of a Session, the Subcode R..W Channels are set to zero.

III.2.4 Subcode/Header synchronization

If the Lead-In Area is encoded as a Data Track then the Header address and the Subcode-Q Absolute Time before CIRC/EFM encoding with a minimum delay encoder (see Yellow Book page 33) must be identical with a maximum tolerance of ± 5 Sectors.

¹ In the Lead-In Area of a disc, the Absolute Time is encoded in the MIN, SEC and FRAME fields of a Subcode-Q Mode-1 frame.

Figure III.3 Example 1 of the encoding of the TOC

Frame number	CONTROL & ADR	TNO	POINT	MIN	SEC	FRAME	ZERO	PMIN	PSEC	PFRAME
n	\$01	0	\$A0	\$97	\$59	\$68	\$00	\$01	\$20	\$00
n+1	\$01	0	\$A0	\$97	\$59	\$69	\$00	\$01	\$20	\$00
n+2	\$01	0	\$A0	\$97	\$59	\$70	\$00	\$01	\$20	\$00
n+3	\$05	0	\$B0	\$32	\$15	\$02	\$02	\$65	\$43	\$21
n+4	\$05	0	\$B0	\$32	\$15	\$02	\$02	\$65	\$43	\$21
n+5	\$05	0	\$B0	\$32	\$15	\$02	\$02	\$65	\$43	\$21
n+6	\$01	0	\$A1	\$97	\$59	\$74	\$00	\$02	\$00	\$00
n+7	\$01	0	\$A1	\$98	\$00	\$00	\$00	\$02	\$00	\$00
n+8	\$01	0	\$A1	\$98	\$00	\$01	\$00	\$02	\$00	\$00
n+9	\$05	0	\$C0	\$00	\$00	\$00	\$00	\$95	\$00	\$00
n+10	\$05	0	\$C0	\$00	\$00	\$00	\$00	\$95	\$00	\$00
n+11	\$05	0	\$C0	\$00	\$00	\$00	\$00	\$95	\$00	\$00
n+12	\$01	0	\$A2	\$98	\$00	\$05	\$00	\$29	\$45	\$02
n+13	\$01	0	\$A2	\$98	\$00	\$06	\$00	\$29	\$45	\$02
n+14	\$01	0	\$A2	\$98	\$00	\$07	\$00	\$29	\$45	\$02
n+15	\$05	0	\$B0	\$32	\$15	\$02	\$02	\$65	\$43	\$21
n+16	\$05	0	\$B0	\$32	\$15	\$02	\$02	\$65	\$43	\$21
n+17	\$05	0	\$B0	\$32	\$15	\$02	\$02	\$65	\$43	\$21
n+18	\$41	0	\$01	\$98	\$00	\$11	\$00	\$00	\$02	\$00
n+19	\$41	0	\$01	\$98	\$00	\$12	\$00	\$00	\$02	\$00
n+20	\$41	0	\$01	\$98	\$00	\$13	\$00	\$00	\$02	\$00
n+21	\$05	0	\$C0	\$00	\$00	\$00	\$00	\$95	\$00	\$00
n+22	\$05	0	\$C0	\$00	\$00	\$00	\$00	\$95	\$00	\$00
n+23	\$05	0	\$C0	\$00	\$00	\$00	\$00	\$95	\$00	\$00
n+24	\$01	0	\$02	\$98	\$00	\$17	\$00	\$11	\$12	\$13
n+25	\$01	0	\$02	\$98	\$00	\$18	\$00	\$11	\$12	\$13
n+26	\$01	0	\$02	\$98	\$00	\$19	\$00	\$11	\$12	\$13
n+27	\$05	0	\$B0	\$32	\$15	\$02	\$02	\$65	\$43	\$21
n+28	\$05	0	\$B0	\$32	\$15	\$02	\$02	\$65	\$43	\$21
n+29	\$05	0	\$B0	\$32	\$15	\$02	\$02	\$65	\$43	\$21
n+30	\$01	0	\$A0	\$98	\$00	\$23	\$00	\$01	\$20	\$00
n+31	\$01	0	\$A0	\$98	\$00	\$24	\$00	\$01	\$20	\$00
n+32	\$01	0	\$A0	\$98	\$00	\$25	\$00	\$01	\$20	\$00
n+33	\$05	0	\$C0	\$00	\$00	\$00	\$00	\$95	\$00	\$00
n+34	\$05	0	\$C0	\$00	\$00	\$00	\$00	\$95	\$00	\$00
.
.

Example of the encoding of the TOC in the Lead-In Area of the first Session of a Read Only Multisession disc. The Program Area of this Session contains two Tracks, Track 1 is a CD-ROM XA Track and Track 2 is an Audio Track. In this example, the Lead-Out Area of the second Session starts at 65:43:21.

Figure III.4 Example 2 of the encoding of the TOC

Example of a Read Only disc with one Audio Session and one CD-ROM XA Session. Encoding of the TOC in the Lead-In Area of the first Session, the Program Area of this Session contains one Audio Track:

Frame number	CONTROL & ADR	TNO	POINT	MIN	SEC	FRAME	ZERO	PMIN	PSEC	PFRAME
n	\$01	0	\$A0	\$97	\$59	\$68	\$00	\$01	\$00	\$00
n+1	\$01	0	\$A0	\$97	\$59	\$69	\$00	\$01	\$00	\$00
n+2	\$01	0	\$A0	\$97	\$59	\$70	\$00	\$01	\$00	\$00
n+3	\$05	0	\$B0	\$32	\$15	\$02	\$02	\$65	\$43	\$21
n+4	\$05	0	\$B0	\$32	\$15	\$02	\$02	\$65	\$43	\$21
n+5	\$05	0	\$B0	\$32	\$15	\$02	\$02	\$65	\$43	\$21
n+6	\$01	0	\$A1	\$97	\$59	\$74	\$00	\$01	\$00	\$00
n+7	\$01	0	\$A1	\$98	\$00	\$00	\$00	\$01	\$00	\$00
n+8	\$01	0	\$A1	\$98	\$00	\$01	\$00	\$01	\$00	\$00
n+9	\$05	0	\$C0	\$00	\$00	\$00	\$00	\$95	\$00	\$00
n+10	\$05	0	\$C0	\$00	\$00	\$00	\$00	\$95	\$00	\$00
n+11	\$05	0	\$C0	\$00	\$00	\$00	\$00	\$95	\$00	\$00
n+12	\$01	0	\$A2	\$98	\$00	\$05	\$00	\$29	\$45	\$02
n+13	\$01	0	\$A2	\$98	\$00	\$06	\$00	\$29	\$45	\$02
n+14	\$01	0	\$A2	\$98	\$00	\$07	\$00	\$29	\$45	\$02
n+15	\$05	0	\$B0	\$32	\$15	\$02	\$02	\$65	\$43	\$21
n+16	\$05	0	\$B0	\$32	\$15	\$02	\$02	\$65	\$43	\$21
n+17	\$05	0	\$B0	\$32	\$15	\$02	\$02	\$65	\$43	\$21
n+18	\$01	0	\$01	\$98	\$00	\$11	\$00	\$00	\$02	\$00
n+19	\$01	0	\$01	\$98	\$00	\$12	\$00	\$00	\$02	\$00
n+20	\$01	0	\$01	\$98	\$00	\$13	\$00	\$00	\$02	\$00
n+21	\$05	0	\$C0	\$00	\$00	\$00	\$00	\$95	\$00	\$00
n+22	\$05	0	\$C0	\$00	\$00	\$00	\$00	\$95	\$00	\$00
.

Encoding of the TOC in the Lead-In Area of the second Session, the Program Area of this Session contains one CD-ROM XA Track:

Frame number	CONTROL & ADR	TNO	POINT	MIN	SEC	FRAME	ZERO	PMIN	PSEC	PFRAME
n	\$01	0	\$A0	\$31	\$59	\$68	\$00	\$02	\$20	\$00
n+1	\$01	0	\$A0	\$31	\$59	\$69	\$00	\$02	\$20	\$00
n+2	\$01	0	\$A0	\$31	\$59	\$70	\$00	\$02	\$20	\$00
n+6	\$01	0	\$A1	\$31	\$59	\$71	\$00	\$02	\$00	\$00
n+7	\$01	0	\$A1	\$31	\$59	\$72	\$00	\$02	\$00	\$00
n+8	\$01	0	\$A1	\$31	\$59	\$73	\$00	\$02	\$00	\$00
n+12	\$01	0	\$A2	\$31	\$59	\$74	\$00	\$65	\$43	\$21
n+13	\$01	0	\$A2	\$32	\$00	\$00	\$00	\$65	\$43	\$21
n+14	\$01	0	\$A2	\$32	\$00	\$01	\$00	\$65	\$43	\$21
n+18	\$41	0	\$01	\$32	\$00	\$02	\$00	\$32	\$17	\$02
n+19	\$41	0	\$01	\$32	\$00	\$03	\$00	\$32	\$17	\$02
n+20	\$41	0	\$01	\$32	\$00	\$04	\$00	\$32	\$17	\$02
n+21	\$01	0	\$A0	\$32	\$00	\$05	\$00	\$02	\$20	\$00
n+22	\$01	0	\$A0	\$32	\$00	\$06	\$00	\$02	\$20	\$00
.

III.3 Program Area

In the second and higher Sessions of a Multisession disc, the Track Number of the first Track in the Program Area has a value that is one higher as the Track Number of the last Track in the Program Area of the previous Session.

The first Track in the Program Area of all Sessions on a Multisession disc starts with a pause encoding (Pre-Gap for Data Tracks) with a length of 00:02:00.

III.3.1 Subcode-Q Channel

The Subcode-Q Channel data in the Program Area of a Session are according to the Yellow Book except when specified otherwise in this chapter.

In the Program Area of a Session Subcode-Q Mode 2 can be present, see chapter III.2.1.2.

During an Audio Track, the ISRC code of that Track can be encoded in Subcode-Q Mode 3. The encoding rules for Mode 3 are given on page 47 of the Red Book.

Figure III.5 Encoding of a Subcode-Q Mode 1 in the Program Area

S0,S1	CONTROL	1	TNO	INDEX	MIN	SEC	FRAME	ZERO	AMIN	ASEC	AFRAME	CRC
ADR												

S0, S1 : According to the Yellow Book.

TNO, INDEX : BCD encoded Track- and Index-numbers.

MIN, SEC, FRAME : Relative Time within a Track in MSF format.

ZERO = 00

AMIN, ASEC, AFRAME : Absolute Time in MSF format.

CRC : 16 bit CRC on CONTROL .. PFRAME (msb first). On the disc the parity bits are inverted. The remainder have to be checked at zero. The check polynomial P(X) is:

$$P(X) = X^{16} + X^{12} + X^5 + 1$$

- CONTROL** : Identification of the kind of information within a Track (bit 3 is the first bit and msb).
- bit 3..0 : The Encoding Identification. The only allowed change of the Encoding Identification within a Track is between "audio without pre-emphasis" and "audio with pre-emphasis".
 - = 00x0 : 2 Audio channels without pre-emphasis
 - = 00x1 : 2 Audio channels with pre-emphasis
 - = 01x0 : Data track.
 - = 01x1 : Data track, recorded incremental (used on CD-WO discs only).
 - = 10x0 : Reserved
 - = 10x1 : Reserved
 - = 11x0 : Reserved
 - = 11x1 : Reserved
 - bit 1 : Copy Bit. It is allowed to change the state of the Copy Bit during a Track. The three defined states of the Copy Bit are: Continuous 0; Continuous 1; Alternating.
 - = Continuous 0 : The Track is copyright protected.
 - = Continuous 1 : The Track is not copyright protected, copying is permitted.
 - = Alternating : The Track is a first or higher generation copy of copyright protected information. The frequency for alternating between 1 and 0 is 9.375 Hz (duty-cycle 50%), which means successively four Subcode Blocks 1 and four Subcode Blocks 0.

III.3.2 Time code and address encoding

With the exception of the Lead-In Area of the first Session, both the Absolute Time and the Sector Address increase monotonically throughout the disc. Both the Absolute Time and the Sector Address have the value 00:00:00 at the start of the first Program Area on a disc.

III.3.3 Subcode-P, -R..W Channels

In the Pre-Gap of the first Track in the first Session of a disc, the Subcode-P Channel is set to one. For the remainder of the Program Areas on a Multisession disc, the Subcode-P Channel is set to zero or is encoded according to the Yellow Book.

In Audio Tracks, the Subcode R..W Channels are encoded according to the Red Book. In Data Tracks and CD-ROM XA Tracks, the Subcode R..W Channels are set to zero.

III.3.4 Subcode/Header synchronization

In a Data Track, the Header address and the Subcode-Q Absolute Time before CIRC/EFM encoding with a minimum delay encoder (see Yellow Book page 33) are identical with a maximum tolerance of ± 5 Sectors.

III.4 Lead-Out Area

The recorded EFM in the Lead-Out Area of a Session is encoded according to the rules given in the Yellow Book or the CD-ROM XA specification. The Lead-Out Area of the first Session of a Multisession disc has a length of 01:30:00. The Lead-Out Area of a second and higher Session of a Multisession disc has a length of 00:30:00.

III.4.1 Subcode-Q Channel

The encoding of Subcode-Q Channel is according to the Yellow Book unless specified otherwise in this chapter.

In the Lead-Out Area of the second and higher Sessions, a pointer to the start address of the first Track in this Session is encoded in Subcode-Q, Mode 5. The value of this pointer is equal to the start address of the first Track in the Session as it is encoded in the TOC of this Session.

Mode 5 is used in the second and higher Sessions of a Multisession disc. Mode 1 and Mode 5 are placed in alternating order. Mode 1 and Mode 5 each occupy at least three out of ten successive Subcode Blocks.

An example of the encoding of Subcode-Q in the Lead-Out Area is given in Figure III.7.

III.4.1.1 Mode 1

The encoding of Mode 1 in the Lead-Out Area of a Session is according to the Yellow Book.

III.4.1.2 Mode 5

Figure III.6 Encoding of a Subcode-Q Mode 5 frame in the Lead-Out Area

S0,S1	CONTROL	ADR	\$AA	POINT	MIN	SEC	FRAME	ZERO	AMIN	ASEC	AFRAME	CRC
TNO												

ADR = 5 : Mode 5
 S0, S1 : According to the Yellow Book.
 CONTROL : See Chapter III.3.1.
 TNO = \$AA
 POINT = \$D1

- AMIN, ASEC and AFRAME contain in MSF format the Start Address of the first Track in the Program Area of this Session as it is encoded in the TOC.
- MIN, SEC, FRAME are reserved and set to 00.
- ZERO contains the BCD encoded Session Number. The Session Number of a Session is one higher than that of the previous Session. The first Session on a disc is counted as Session Number one.

All not defined values of POINT are reserved for future use.

III.4.2 Time code and address encoding

With the exception of the Lead-In Area of the first Session, both the Absolute Time and the Sector Address increase monotonically throughout the disc.

III.4.3 Subcode-P, -R..W Channels

In the Lead-Out Areas of a Multisession disc, the Subcode-P Channel is set to zero or is encoded according to the Yellow Book. In the Lead-Out Area of a Session, the Subcode R..W Channels are set to zero.

III.4.4 Subcode/Header synchronization

If the Lead-Out Area of a Session is encoded as a Data Track (see Yellow Book chapter VI.3) then the Header address and the Subcode-Q Absolute Time before CIRC/EFM encoding with a minimum delay encoder (see Yellow Book page 33) must be identical with a maximum tolerance of ± 5 Sectors.

Figure III.7 Example of the encoding of the Lead-Out Area

Frame number	CONTROL & ADR	TNO	POINT	MIN	SEC	FRAME	ZERO	AMIN	ASEC	AFRAME
n	\$41	\$AA	\$01	\$00	\$12	\$68	\$00	\$61	\$59	\$62
n+1	\$41	\$AA	\$01	\$00	\$12	\$69	\$00	\$61	\$59	\$63
n+2	\$41	\$AA	\$01	\$00	\$12	\$70	\$00	\$61	\$59	\$64
n+3	\$45	\$AA	\$D1	\$00	\$00	\$00	\$02	\$52	\$12	\$34
n+4	\$45	\$AA	\$D1	\$00	\$00	\$00	\$02	\$52	\$12	\$34
n+5	\$45	\$AA	\$D1	\$00	\$00	\$00	\$02	\$52	\$12	\$34
n+6	\$41	\$AA	\$01	\$00	\$12	\$74	\$00	\$61	\$59	\$68
n+7	\$41	\$AA	\$01	\$00	\$13	\$00	\$00	\$61	\$59	\$69
n+8	\$41	\$AA	\$01	\$00	\$13	\$01	\$00	\$61	\$59	\$70
n+9	\$45	\$AA	\$D1	\$00	\$00	\$00	\$02	\$52	\$12	\$34
n+10	\$45	\$AA	\$D1	\$00	\$00	\$00	\$02	\$52	\$12	\$34
n+11	\$45	\$AA	\$D1	\$00	\$00	\$00	\$02	\$52	\$12	\$34
n+12	\$41	\$AA	\$01	\$00	\$13	\$05	\$00	\$61	\$59	\$74
n+13	\$41	\$AA	\$01	\$00	\$13	\$06	\$00	\$62	\$00	\$00
n+14	\$41	\$AA	\$01	\$00	\$13	\$07	\$00	\$62	\$00	\$01
n+15	\$45	\$AA	\$D1	\$00	\$00	\$00	\$02	\$52	\$12	\$34
n+16	\$45	\$AA	\$D1	\$00	\$00	\$00	\$02	\$52	\$12	\$34
.
.

Example of the encoding of Subcode-Q in the Lead-Out Area of the second Session of a Multi Session disc.

IV. Data Retrieval Structure

A Multisession CD can contain both Audio Sessions and Data Sessions (Mode 1, CD-ROM XA or CD-I). All Data Sessions on a Multisession CD must be of the same type (Mode 1, CD-ROM XA or CD-I).

All Tracks in an Audio Session must be Audio Tracks. The first Track in a Data Session must be a Data Track, the remaining Tracks in a Data Session can be both Audio or Data Tracks. Within a Data Session, an Audio Track can not be followed by a Data Track.

IV.1 Logical addressing

Logical Sector Addresses on a Multisession CD are calculated by means of the following formula:

$$LSA = 4500 * PSA[mm] + 75 * PSA[ss] + PSA[ff] - 150$$

In which:

LSA	=	Logical Sector Address.
PSA	=	Physical Sector Address in mm:ss:ff. The PSA of a Sector is the header address of this Sector.
PSA[mm]	=	mm fraction of the Physical Sector Address.
PSA[ss]	=	ss fraction of the Physical Sector Address.
PSA[ff]	=	ff fraction of the Physical Sector Address.

IV.2 File System

If a Multisession CD contains the ISO 9660 file system, then it is recommended that the following requirements are fulfilled:

- The last Session of the disc is a Data Session.
- If the Data Sessions are CD-ROM XA Sessions, then the CD-ROM XA extensions of the ISO 9660 file system must be used (see CD-ROM XA, chapter III).
- Sector 16 of the last Session contains the Primary Volume Descriptor (see ISO 9660) for the total disc. The address of Sector 16 of a Session is obtained by adding 00:00:16 to the TOC value of the first Track in the Program Area of this Session.

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List of Changes

Changes from "Multisession Compact Disc Specification Version 0.9, March 1995" to "Multisession Compact Disc Specification Version 1.0, December 1995"

The main changes from the Multisession Compact Disc Specification Version 0.9 to the Multisession Compact Disc Specification Version 1.0 are:

- The only way to indicate the Final Session of a Read Only disc is now the fact that Mode 5/POINT=\$B0 is not present in the Lead-In Area of the last Session.
- Editorial changes.

The following list gives a summary of all changes from Version 0.9 to Version 1.0. The chapter and figure numbers in the list refer to the numbers found in the Multisession Compact Disc Specification Version 1.0.

Chapter/ Figure	Changes made		Remarks
	Version 0.9	Version 1.0	
III.2.1.3	... is called the Final Session. The Final Session is indicated ... is not present.	... is always designated as the Final Session of that disc. On a CD-R disc ... Final Session of the disc.	Clarification Rule for the Final Session of Read Only discs changed
III.2.2	The last Absolute Time ¹ in the Lead-In Area ...	The last Absolute Time in the Lead-In Area ...	Footnote added, clarification
III.2.4	the Subcode-Q Relative Time before CIRC/EFM encoding ...	the Subcode-Q Absolute Time before CIRC/EFM encoding ...	Editorial
Figure III.3, POINT=\$B0	PMIN, PSEC, PFRAME = \$00, \$00, \$00	PMIN, PSEC, PFRAME = \$65, \$43, \$21	Corrected
Figure III.3	... Multi Session disc. --	... Multisession disc. In this example, the Lead-Out Area of the second Session starts at 65:43:21.	Editorial Clarification
Figure III.4	--		Figure added, clarification
IV.2	... the CD-ROM XA extensions of the ISO 9660 file system must be used.	... the CD-ROM XA extensions of the ISO 9660 file system must be used (see CD-ROM XA, chapter III).	Reference added

List of Changes

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